Quarterly Report 3 – Public Page

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Contract Number: DTPH56-06-T-000020

Prepared for: DOT/PHMSA and GTI SMP (Sustaining Membership Program)

Project Title: Phase Sensitive Methods to Detect Cathodic Disbondment

Prepared by: Gas Technology Institute

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Objective and Public Abstract

The proposed work is to develop a phase sensitive technology that could detect coating disbondment on steel pipe from above ground, thus locating potential corrosion failure points. The system would consist of two components, a stationary signal generator that is attached to a test point and a detector that is carried along the pipeline. Sinusoidal or pulse excitation signals may be used. A wireless link between the generator and the detector provides accurate synchronization. An abrupt change of signal phase is expected at the disbondment.

There is no exterior method that can reliably detect disbonded coating at this time. Existing pipeline potential gradient surveys, both DC and AC, make use of only amplitude data. While amplitude methods can detect a break (holiday) in the coating, a disbonded coating can shield active corrosion from both detection and cathodic protection; the space between a disbonded coating and the pipe can house an active corrosion cell. Until there is an actual holiday in the coating, the corrosion cell cannot now be detected. A holiday will allow increased cathodic protection current to flow to the pipe in the immediate vicinity of the holiday, but may not reach the extremities of a large disbondment.

A disbonded coating can “shield” active corrosion that is undetectable until serious damage has occurred to the pipe wall. The coating also shields the disbondment from detection by DC or AC voltage gradient surveys. Internal methods, such as magnetic flux leakage (MFL) pigging may detect wall thinning but will not differentiate causes. MFL pigging is expensive and may not be possible on lines with bends or diameter changes. The proposed work is to provide a completely new method for surveying pipelines.

The object of the proposed work is to develop a technology that could detect coating disbondment on steel pipe from above ground, thus identifying potential corrosion locations before the pipeline fails. The deliverable would be prototypes of two components, a stationary signal generator and a hand carried detector. The signal generator would be attached to the pipeline at a test station. The hand-held device would be carried along the pipeline to acquire signal phase and amplitude measurements from the pipeline. A wireless link would synchronize the two devices.

Progress to Date

In Quarter 1, an advisory group was formed from members of GTI's Sustaining Membership Program (SMP) Technical Guidance Committee (TGC.) The group was sent a survey form to determine which members were interested in participating and what types of pipes and coatings they have in place.

A state of art assessment document was drafted and circulated to the advisory group. GTI determined there is presently no method to detect or locate a disbonded coating from above ground. As part of the assessment, a patent research was performed, and no technologies relating to Phase Sensitive Methods to Detect Cathodic Disbondment were found. There are, however, other technologies that detect cathodic disbondment by other means. The assessment is available on the PHMSA website.

In Quarter 2, GTI received four survey responses from SMP TGC members in different parts of the country. Two of these companies expressed interest in hosting a prototype demonstration. A draft test plan was created based on the survey results and sent to the advisors for review. The purpose of the test plan is to define a reasonable subset of coated steel pipe types that can be used to verify the operation of a prototype cathodic disbondment detector. Once approved, GTI will fabricate a representative set of test samples and conditions.

The Quarter 3 activities are summarized below.

Task 1 (Parametric Studies)

To summarize the status of Task 1 Team Project Activities from the agreement to date:

Task 1 - Parametric Studies

- Catalog the most common pipe and coating materials – Initial catalog completed through survey; final version will be completed through approval of test plan
- Identify a reasonable subset of these to use experimentally – In process; to be completed with approval of test plan.
- Form a Project Advisory Committee from SMP and DOT to review findings (1) – Completed.
- Get consensus on minimum size of disbondment that needs to be found – In Process.
- Get agreement on the pipe and coating sub-set from the members – In Process.
- Identify one utility test site that fits within the set – In Process
- Prepare formal Experimental Test Plan and get Advisors approval (3) – Draft Test Plan compiled and included in this report. Will be sent to advisors for approval.
- Using transmission line theory, estimate the phase shift per foot of pristine pipe – In Process
- Estimate the additional phase shift created by a disbondment – In Process
- Obtain soil impedance data with emphasis on test site area – Not Started
- Calculate theoretical minimum size of disbondment that is detectable – In Process

Task 2 (Prepare Representative Disbondment Samples)

A small amount of work has been performed in Task 2. Some consideration has been give to the procedure for constructive artificial disbondments of know size. Actual construction of disbondments must wait until the Experimental Test Plan is finalized and pipe samples in hand.

Task 3 (Construct a Breadboard Instrument)

No work has been performed on Task 3 at this writing.

Task 4 (Test the Breadboard Instrument)

Some consideration has been given to where to bury samples on GTI property for testing and calibration. This anticipates that Tasks 2 and 3 will be successfully concluded. It is necessary to plan land use well in advance.

Task 5 (Project Management and Reporting)

The Peer Review presentation was given on March 27, 2007. Monthly reports were submitted to the PHMSA online system on April 16th and May 16th respectively. The 3rd Quarterly Technical Report was submitted on June 15th. The GTI Technical Team Manager was formally changed from Max Kieba to Chris Ziolkowski in May.

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